
Greater genius

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John von Neumann and the Origins of Modern Computing. By William Aspray. MIT Press: 1990. Pp. 376. £31.50, \$35.

ASK anyone who were the greatest figures in computer history and the names of Charles Babbage, Alan Turing and John von Neumann will inevitably recur. Of the trio, only von Neumann (1903 – 1957) lacks a biographer, even though in terms of his actual impact on the development of the computer, he was easily the most influential. (Hence the term, 'von Neumann' machine, which is often used to describe the modern electronic digital computer.)

As one of the most brilliant and precocious scientists of the twentieth century, the main outline of von Neumann's life is already well known. Born in Hungary and educated in Germany, von Neumann had already made major contributions to quantum mechanics and mathematical logic, before taking up a professorship (and then American nationality) at the Institute for Advanced Study (IAS) at Princeton in 1930. He therefore came to computing relatively late in life, largely as a result of the Second World War, when the demand for greater computational power for projects such as the development of the atomic bomb drew von Neumann into the field of calculation. Henceforth, it accounted for a major part of his time. Von Neumann, it seems, was unable to work in any field without leaving the characteristic imprint of his logical and wide-ranging mind, and computing was no exception. His involvement with government-funded projects produced his highly influential report of 1945 on the Electronic Discrete Variable Computer, which was the virtual blueprint for the stored-program digital computer. His reputation and influence greatly raised the standing of the emerging computer profession and allowed von Neumann himself to construct one of the earliest machines within the cloistered confines of the IAS at Princeton in the early 1950s. It sparked research into a variety of scientific fields and was widely copied. By his own example, von Neumann also ensured that technical knowledge about the computer was placed in the public domain.

But as William Aspray demonstrates in this book, what made von Neumann so notable (aside from his greater genius) amongst his fellow pioneers was that his work extended well beyond the design and construction of computer systems. Like Turing, von Neumann regarded computers only as a means to an end; in other words, it was computer applications that provided the greatest stimulus to his

talents. Half of the book is therefore devoted to a detailed treatment of von Neumann's work in this sphere.

Von Neumann was one of the first to realize that new mathematical methods would be needed to use the computer effectively and he helped set out the research agenda for computer-orientated numerical analysis. At Princeton, he also established a meteorology project, which helped prepare the first computer methods for weather forecasting and led to the production of daily numerical forecasts. Naturally, he applied the computer to various scientific problems as the opportunity arose and this allowed him to make contributions in fields as diverse as atomic physics, fluid dynamics and traffic simulation. More importantly, von Neumann was fascinated by the analogy between the digital computer and the human brain. Almost singlehandedly he blazed a trail into the theoretical field of information processing systems, or automata, and introduced such themes as learning, reliability of systems with unreliable components, self-replication, and the problems of memory and storage capacity in biological nervous systems. This work, which was tragically and prematurely ended when von Neumann died of cancer in 1957, remains central to modern concerns with parallel processing and artificial intelligence.

Because von Neumann was "violently anti-Communist . . . and more militaristic than most" (his own words), not all of his energies were directed towards constructive ends. It was in America's growing military-industrial complex that he found his true spiritual home and much of his later work involved the development of bombs and delivery systems. Yet, in contrast to Andrew Hodges' recent biography, *Alan Turing: The Enigma of Intelligence*: Burnett Books/Hutchinson, London, 1983 and Steve Heims' study, *John von Neumann and Norbert Weiner: From Mathematics to the Technologies of Life and Death*: MIT Press, Cambridge, 1980, the political, military and economic

dimension are only lightly sketched here. Only a brief final chapter looks at von Neumann as scientific consultant and statesman and there is no discussion of von Neumann's deeper motivations. On the other hand, this book is far better documented than Heims' — Aspray has clearly researched far more archives than any other writer — and it is not intended as a full-scale biography. Within its narrower focus it succeeds admirably and is a



Von Neumann — brilliant and precocious.

major addition to the MIT Press's excellent series on the history of computing. The author's extensive knowledge of the subject enables him to bring new and interesting insights into every aspect of von Neumann's work. He allows us to see the true scale of von Neumann's achievements in computing for the first time and firmly establishes his reputation as the most influential computer pioneer of all time. □

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